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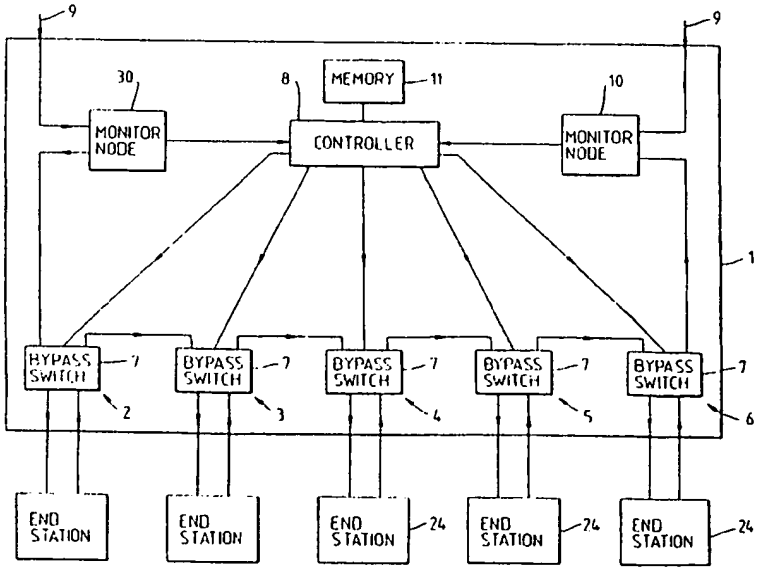
(54) Communication system

(57) A method of analysing a communication system to locate the source of a fault. The communication system comprises a signal carrying medium (9) coupled to a series of end station ports (2-6) which enable respective end stations (24) to transmit signals onto and receive signals from the medium and a controller (8) to control connection of end stations (24) to the medium via the ports (2-6). The method comprises disconnecting end stations (24) in series from the medium (9) in response to detection of a fault and then detecting whether the fault still exists. A fault analyzer (10) adapted to respond to the detection of a fault causes the controller (8) firstly to disconnect an end station (24) which has previously been characterised as the most likely source of a fault. The controller (8) may disconnect groups of end stations (24) and reconnect subgroups if no fault is present in the group which was not disconnected until the faulty end station is identified.

Fig.1.



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EUROPEAN SEARCH REPORT

Application Number
EP 96 20 1128

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	EP 0 244 775 A (HITACHI LTD) 11 November 1987 * column 4, line 9 - column 5, line 31 * * column 12, line 39 - column 13, line 5 * * figure 7 *	1,2	H04L12/26 H04L12/42
Y	TECHNOLOGY: EMERGING OR CONVERGING?, OTTAWA, APRIL 23 - 27, 1989, vol. 3, 23 April 1989, INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, pages 989-997, XP000076755 NAKAYASHIKI S ET AL: "WRAPPING AND MERGING RECONFIGURATION MECHANISM OF A COUNTER-ROTATING DUAL RING" * paragraph 5.2 *	1,2	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
H04L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 April 1997	Perez Perez, J

CATEGORY OF CITED DOCUMENTS

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H04L 12/42
H04L 12/44

Fibre Channel Standard Hub-Loop Redundancy for Higher RAS

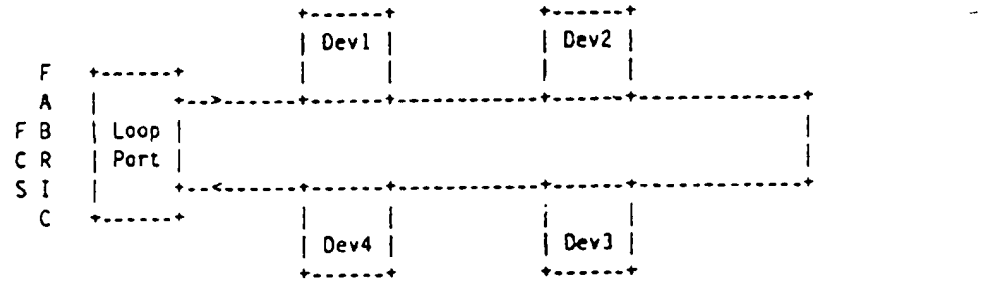
XP 000446711

p. 383-385 (3)

A traditional loop can fail if any of its components fail (i.e., one component failure can take down the entire loop unless a redundant path or dual loop is implemented - which can be costly). Described is a mechanism which provides redundancy without duplication.

For the emerging ANSI Fibre Channel Standard (FCS), one of the physical topology options for a low-cost version is a HUB-LOOP. HUB-LOOPs provide benefits over the traditional loop in that devices can be hot-plugged or turned off-line, and additional performance is realized. Also, the device on such a loop requires certain special characteristics (e.g., if it "sees" a frame which has a different address than the device address, it passes the frame on) which the normal FCS-attached device does not have. A HUB-LOOP shields the end device so that the attachment to the loop is transparent.

Consider the following traditional loop structure (Note: only four devices are shown for brevity; the FCS FABRIC and Loop Port connection may or may not be present.):



Each device looks at the incoming frame and, if it is not one that is expected (i.e., the correct address), the device sends the frame to the next device on the loop. If the device is off-line, needs to be removed, or the loop breaks, the entire loop is non-operational.

Now, consider the HUB-LOOP (Note: only four devices are shown for brevity; the FCS FABRIC connection may or may not be there.):

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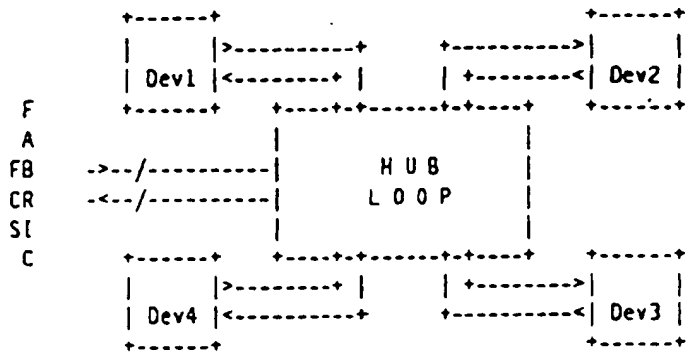
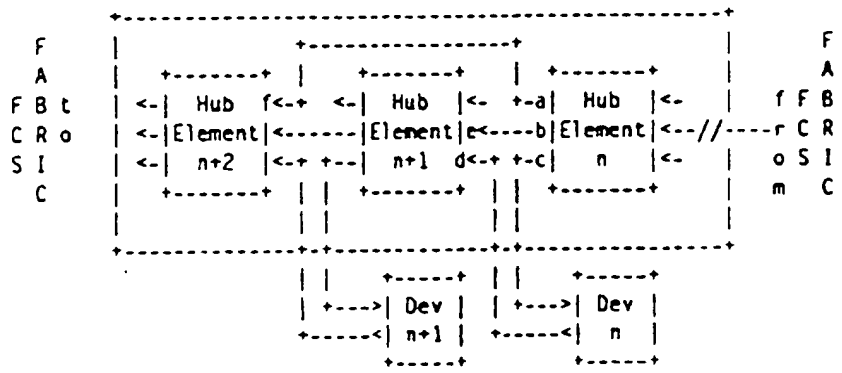


From a device point-of-view, the HUB-LOOP can be completely transparent device; i.e., there is no difference from being attached directly to the FCS Fabric.

The following describes a low-cost HUB-LOOP that has extra reliability built in.

Intelligent HUB-LOOPs can do switching (i.e., they do not pass each frame out to each of the attached devices). If we view this pictorially, we have (only a portion of a HUB-LOOP is shown for brevity):



With the above picture in mind, a frame comes from the right and leaves on the left if there is an additional FCS Fabric (otherwise, the only entrance and exit points are to each device). Without 'a' and 'b' (see Hub Element n), the HUB-LOOP acts as a normal distribution box and logically looks like a complete loop (i.e., the frame leaves Hub Element n, goes to Device n and if it has a different address (not 'n'), is passed back to Hub Element n + 1 at point 'd'). By adding 'b' to 'e', if the link to Device n is not active (i.e., broken, device turned off, etc), the frame can travel directly to 'e'. If there is enough intelligence in Hub Element n, it may decide to pass only the frames for Device n to Device n and shunt the rest directly to 'e'.

For redundancy, an additional path 'a' to 'f' has been added for a relatively small increment of cost (i.e., Hub Element n + 1 must already look at entry points 'd' and 'e' to decide which one is active. Now, it only makes an additional check on 'f'. With this addition, if any problem occurs with Hub Element n + 1, Device n + 1 would be "missing" from the loop, but the loop would continue to operate.

By adding path 'a' to 'f', we create additional protection from failure to a HUB-LOOP for little additional cost.